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Lacto: A new and healthful frozen dairy product

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Lacto: A New and Healthful Frozen Dairy Product

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DAIRY SECTION

AMES, IOWA

SUMMARY

1. Lacto is a new frozen product made of loppered whole or skim milk, with the addition of eggs, sugar, lemons, and flavoring material. Page 269.

2. Lacto has a more pleasing flavor than sherbets and ices, and contains considerably more nutriment. It contains as much protein as ice cream, less fat, and more acid. Page 280.

3. Out of 179 persons who sampled lacto, 128 pronounced it very good, 37 good, 6 fair, and 8 poor. Comparing it with common vanilla ice cream, 111 reported that they preferred lacto, 9 considered it equal to ice cream, and 59 preferred the ice cream. Comparing lacto to sherbet, 123 preferred lacto, 30 preferred sherbet, and 26 considered lacto equal to sherbet. Page 272.

4. Science has shown that the presence of putrefactive bacteria in the intestines may be very detrimental to health. Lactic acid bacteria, which are entirely harmless, will largely replace these putrefactive forms. Loppered milk and buttermilk will supply lactic acid bacteria, but are objectionable to many people on account of their flavor. Lacto supplies these lactic acid bacteria in large numbers and contains no putrefactive or other forms. Page 278.

5. The lactic acid bacteria in lacto remain alive for some time after being frozen, but there is no further growth nor production of acid. Page 273.

LACTO: A NEW AND HEALTHFUL FROZEN DAIRY PRODUCT

M. MORTENSEN JOHN GORDON

INTRODUCTION

For several years one of the writers experimented with the preparation of drinks from sour milk flavored with fruit juices. At one time an attempt was made to place such a product on the market, but on account of lack of time for advertising, no great demand for it was created.

During the past year the Dairy Section of the Iowa Experiment Station took up the same experiments, but froze the product to the same consistency as ice cream. At first the experiments were conducted with buttermilk flavored with various fruit juices. So far we have been unable to produce a combination of flavors with the buttermilk which is absolutely satisfactory, although the buttermilk has been of good quality. Later skimmed milk which had been soured by a commercial lactic acid culture was substituted for the buttermilk. This combined with eggs and the various fruit flavors gave a product which possessed a delicate flavor. We found that many people who disliked the flavor of buttermilk relished this product, which has been called "lacto."

PREPARATION OF MILK USED FOR MANUFACTURE OF LACTO

The milk for lacto is prepared in a similar manner to the starter which is used for cream ripening. A commercial lactic acid culture is used. This is added to a pint of skimmed milk which has been pasteurized at a temperature of 85 degrees C (185 F.) for twenty minutes, and after pasteurization cooled to from 20 to 22 degrees C. (68-71 F.). The lactic acid culture is mixed thoroughly with the milk and left at 20 degrees C. (68 F.) until the milk has coagulated. Then another bottle of skimmed milk is pasteurized and cooled in the same manner, but instead of the commercial culture, a part of the coagulated milk is added to insure the souring of the milk inside of eighteen hours. This operation is repeated until the final batch of soured milk obtained has lost the undesirable flavor due to the substance in which the commercial culture was preserved. After

this point has been reached, which requires from four to six days, the last sample of soured milk obtained is added to a larger amount of pasteurized skimmed milk. This is then treated the same as the former lots. In this way an amount of milk sufficient to work with is obtained.

Where lacto is to be made in the household on a small scale it may prove too expensive to buy commercial lactic cultures. A family recipe then would be as follows:

Take a bottle of good clean fresh milk which has not been heated, set it away at a temperature of from 68 to 70 degrees F. until it coagulates. If it coagulates as a smooth solid curd without pin holes, if the aroma is clean and pleasant, and the flavor nice and creamy, it can be used as a starter for a larger amount of pasteurized whole or skimmed milk.

The milk when ready to be used for lacto has an acidity of .7 to .8 of 1 per cent expressed in terms of lactic acid. It must be of a mild and clean acid flavor. The curd must be thoroughly broken up. This is accomplished by pouring it from one pail to another until it is as smooth and velvety as rich cream. From this milk, which in this connection we will call "lacto milk," the various lactos are prepared by the following formulas:

FORMULAS FOR LACTO

Each of the following formulas will make 5 gallons of the finished product.

Cherry Lacto
- 3 gallons lacto milk
- 9 pounds sugar
- 12 eggs
- 1 quart of cherry juice or concentrated cherry syrup
- 1½ pints lemon juice

Orange Lacto
- 3 gallons lacto milk
- 11 pounds sugar
- 12 eggs
- 2½ quarts orange juice
- 1½ pints lemon juice

Mint Lacto
- 3 gallons lacto milk
- 9 pounds sugar
- 12 eggs
- 1 pint concentrated Creme de Menthe syrup
- 2½ pints lemon juice

Pineapple Lacto
- 3 gallons lacto milk
- 9 pounds sugar

12 eggs
½ gallon grated pineapple
1½ pints lemon juice

Marachino Lacto
3 gallons lacto milk
9 pounds sugar
12 eggs
1 quart marachino cherries grated
1½ pints cherry juice or concentrated cherry syrup
1½ pints lemon juice

Raspberry Lacto
3 gallons lacto milk
9 pounds sugar
12 eggs
1 quart red raspberry juice or concentrated syrup
1½ pints lemon juice

Grape Lacto
3 gallons lacto milk
9 pounds sugar
12 eggs
1 quart grape juice
1½ pints lemon juice

PREPARING THE MIXTURE

The sugar is first dissolved in the lacto milk. The eggs are then prepared. The whites and yolks are kept in separate containers and each lot is beaten with an egg beater. Both the yolks and whites are then added to the milk. The mixture is thoroughly stirred and strained through a fine wire gauze. The fruit juices are added last. If there is any indication of the juices precipitating the casein, they should be left out until the mixture has begun to freeze, when they may be added. The freezer is now run until it turns with difficulty, when the paddle is removed. The brine is removed and the freezer repacked with ice and salt and left for an hour before the contents are served.

TEST OF THE COMMERCIAL VALUE OF LACTO

In order that we might determine the commercial value of lacto we sent samples to various families and requested that they give us their sincere opinion of the product. Reports were received as follows:

TABLE 1. TESTS OF COMMERCIAL VALUE OF LACTO

Kind of Lacto	Date, 1910	Number parties reporting	Poor	Fair	Good	Very good	Number preferring lacto to vanilla ice cream	Number preferring vanilla ice cream to lacto	Number considering vanilla ice cream and lacto equal	Number preferring lacto to sherbet	Number preferring sherbet to lacto	Number considering lacto and sherbet equal
Mint	6/18	17		1	2	14	10	5	2	13	2	2
Marachino	6/20	19			3	16	12	6	1	12	3	4
Pineapple	6/21	54	8	1	13	32	30	23	1	30	9	15
Orange	6/24	24		2	7	15	14	7	3	20	3	1
Strawberry	7/1	30		1	8	21	19	11		18	11	1
Raspberry	7/2	14				14	11	3		11	1	2
Cherry	7/5	21		1	4	16	15	4	2	19	1	1
Total		179	8	6	37	128	111	59	9	123	30	26

In order to obtain a more reliable estimate of its market value we offered it for sale at the college creamery, charging the same price, 35 cents per quart, as was charged for ice cream. The sales referred to are all retail sales and made mostly to parties knowing the product. The results from eight days sales were as follows:

TABLE 2

Date of sale	Kind of lacto	Quarts ice cream sold	Quarts lacto sold	Percent of total sales lacto	Remarks
July 2.....	Strawberry	14½	10	40.8	
July 6.....	Cherry	5	9	64.3	
July 7.....	Cherry	19	3	13.6	Short of Lacto
July 8.....	Pineapple	8	12½	61.0	
July 12.....	Cherry	14¼	10	40.8	
July 15.....	Pineapple	14	5	26.3	
July 16.....	Pineapple	21	14½	40.8	
July 30.....	Raspberry	4	24	85.7	
Total.....		99¾	88	46.8	

The foregoing table indicates that lacto has a commercial value. There seems to be no reason why it should not within a reasonable time become just as popular as sherbet.

BACTERIOLOGICAL ANALYSES OF LACTO SHOWING THE EFFECT OF FREEZING UPON THE LACTIC ACID BACTERIA

METHOD OF PROCEDURE

Samples of various flavors of lacto were frozen, placed in quart Mason jars, and packed in refrigerating rooms in buckets

with ice and salt. The packing was changed twice daily, allowing an average temperature of -10 degrees C. to be maintained Bacteriological analyses were made of the original starter or lacto milk, of the unfrozen lacto before freezing, and starting two hours after freezing, analyses were made for periods covering 42 days. In the analyses one cubic centimeter was used in all instances and dilutions ranging from 1/100 to 1/100,000,000 were made therefrom. In order to secure a representative sample of the frozen lacto in the jars, a sterilized cheese trier was used in the same manner as in sampling cheese. The sample was allowed to melt in the laboratory, and a cubic centimeter removed after mixing. The medium was litmus lactose gelatine. All plates were incubated for five days at 20 degrees C. Duplicate samples were taken of four flavors; raspberry being Nos. 1 and 2, orange Nos. 3 and 4, mint Nos. 5 and 6, and pineapple Nos. 7 and 8. The results obtained are shown in the following table.

TABLE 3

No. of Bacteria in Lacto

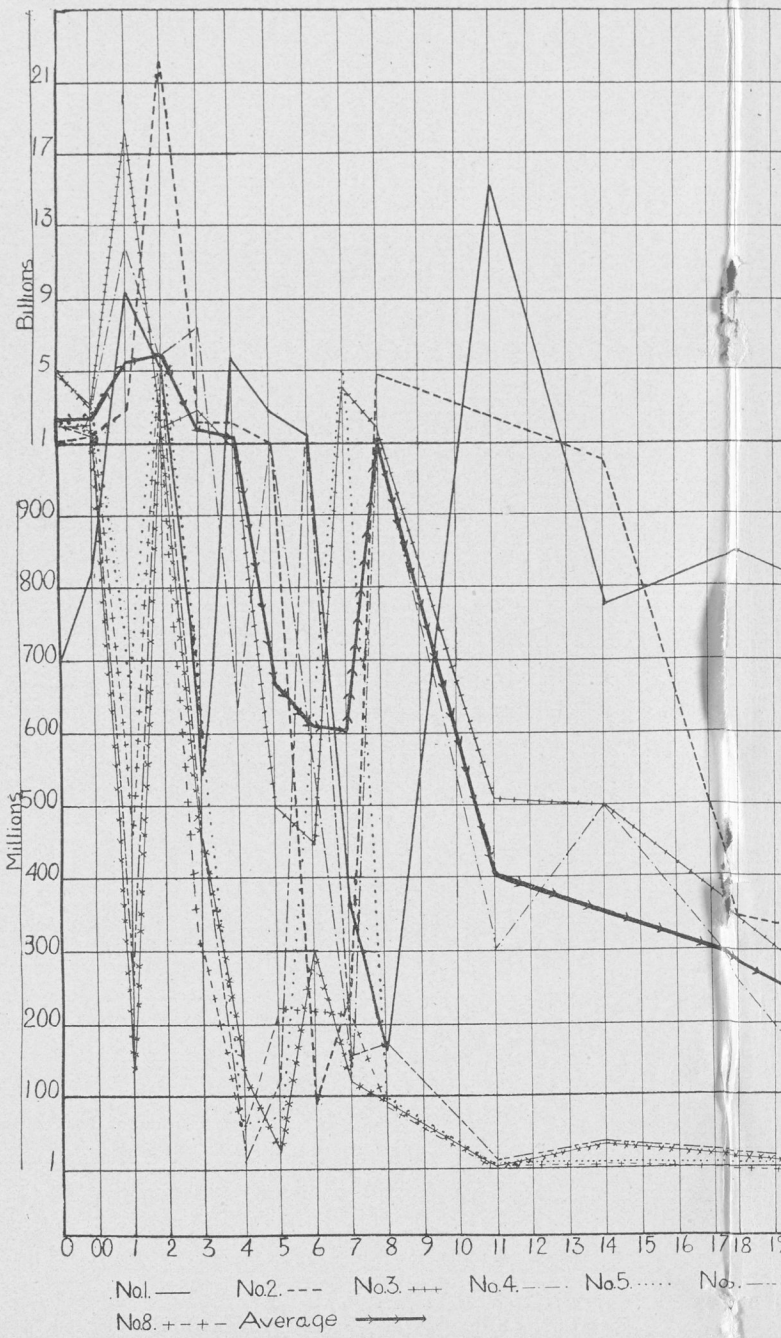
Numbers are in terms of millions

Time	No1	No2	No3	No4	No5	No6	No7	No8
Starter	700	1020	4800	4800	1700	1700	1700	1700
Mixed	820	1360	2400	2900	2130	1280	2000	3000
1st day	9120	2000	18000	11400	670	254	138	460
2nd "	5400	211600	1340	5800	4000	4800	1780	1900
3rd "	500	1800	2400	7200	650	450	450	275
4th "	6000	1780	1025	640	70	14.5	120	60
5th "	2425	1000	500	1000	77	130	30	223
6th "	1600	90	460	130	525	1550	300	220
7th "	360	240	4050	270	4.6	160	130	210
8th "	176	4700	1650	1030	100	17.5	108	85
11th "	15000*	2000	510	300	7.5	12.5	3.5	2.1
14th "	775	975	500	500	10	39	35	2.4
18th "	850	340	—	—	—	—	—	—
22nd "	—	—	190	140	—	—	—	1.6
42nd "	30	9	.09	1	11	.01	.01	.95

* Not used in computing averages.

It is to be observed that while forms of bacteria other than lactics may have entered the lacto through the sugar, air, contamination in preparation, etc., they did not survive. In making the counts, occasional molds and non acid forms were encountered, but because of the very high dilutions used and of the scarcity of such forms, they were ignored. Large numbers

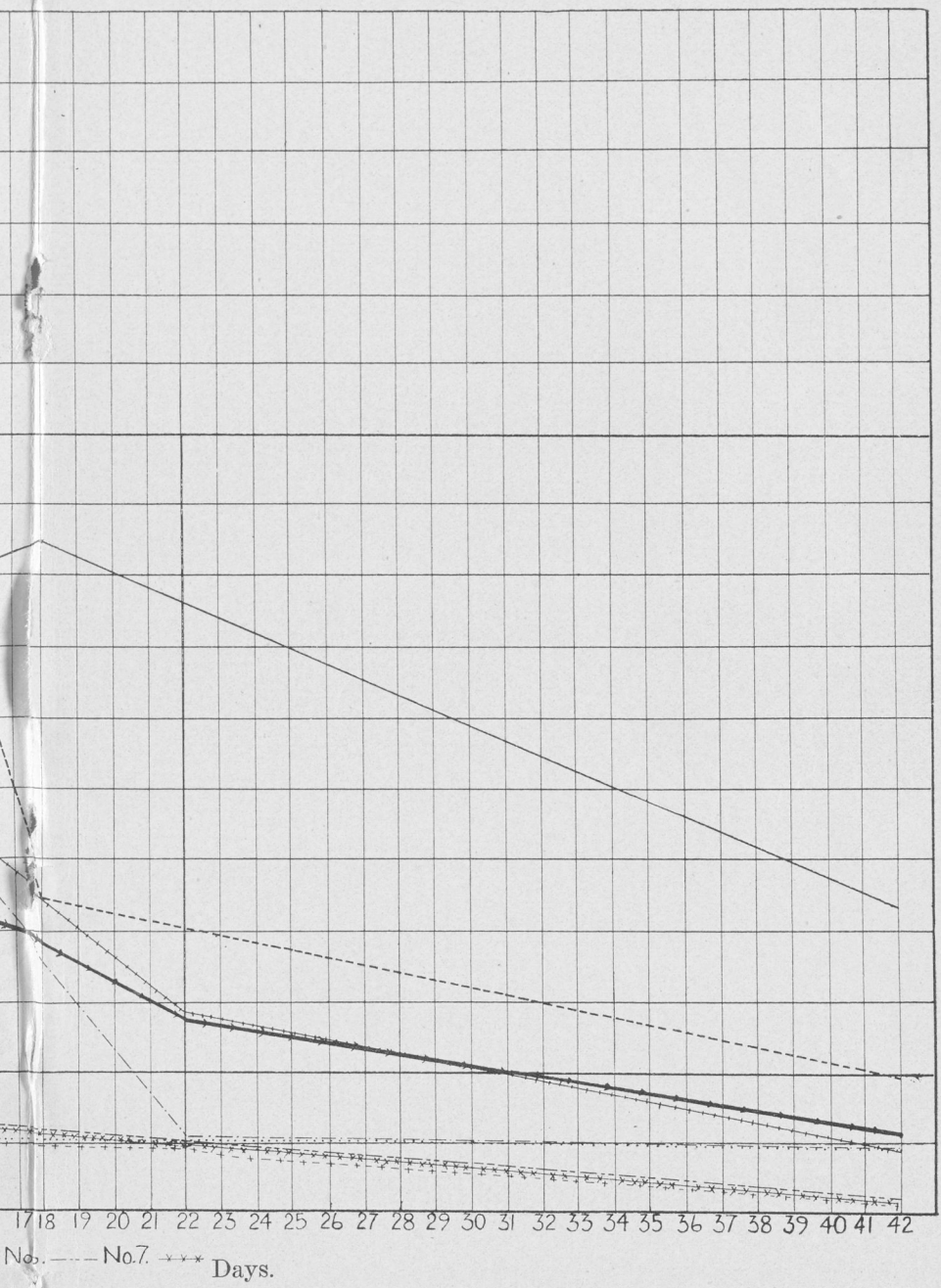
VARIATIONS IN NUMBER



Numbers of Bacteria per cc.

CHART I

NUMBER OF BACTERIA DURING STORAGE



of the lactic acid bacteria survive freezing for a long period. The number falls off gradually. The decrease begins shortly after storage and grows more pronounced toward the latter end of the storage period.

There is no increase of non-acid forms and molds even after long storage.

There is no increase in the number of lactic acid bacteria. There is a seeming increase after mixing and freezing, but this is merely due to the breaking up of lumps. The after fluctuations upward in the numbers are probably due to errors in sampling owing to the tendency of the serum of the lacto milk to separate from the solids. For this reason lacto should be stored at a uniformly low temperature.

Even after long storage lacto contains ample numbers of lactic acid bacteria to produce beneficial results when taken into the body.

The effect of flavors upon the lactic acid bacteria is doubtful. The orange and pineapple flavorings appear to reduce the numbers of bacteria. Their action is probably only indirect, the extra acidity which they add being unfavorable to the bacteria.

Acidities were taken during storage with N/10 NaOH upon four samples of lacto, representing orange and mint flavors. Expressed in terms of lactic acid they are as follows:

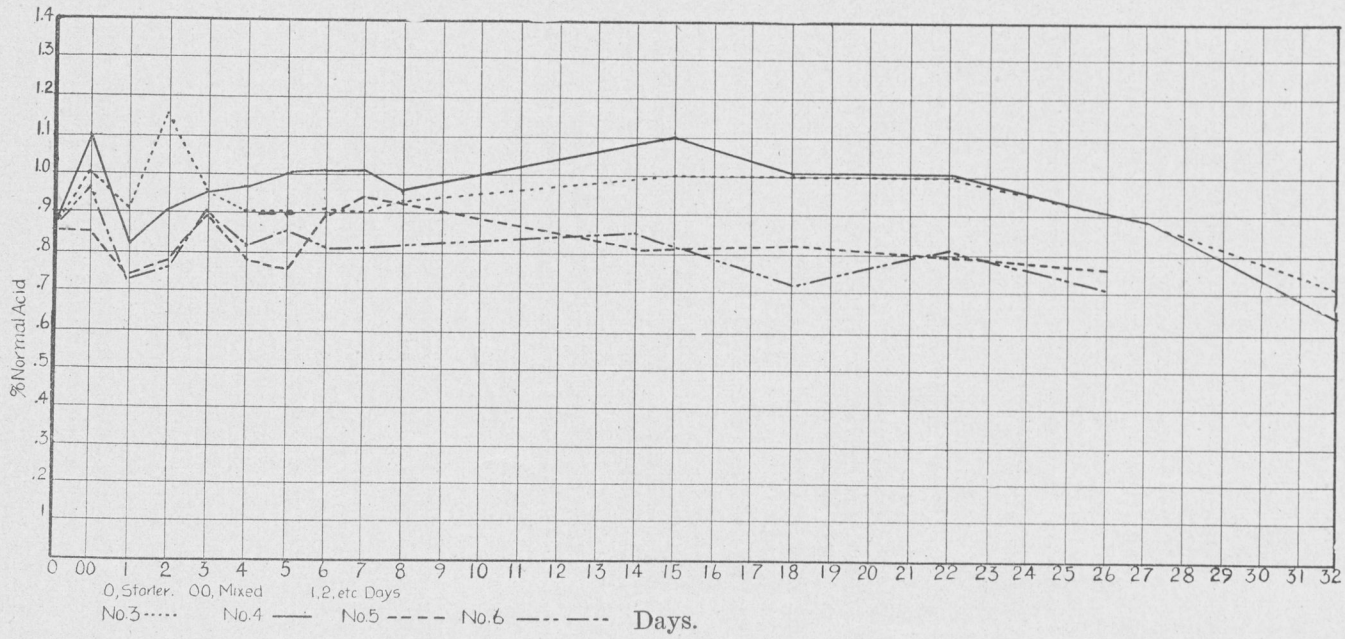
TABLE OF ACIDITIES

% Normal Acid in Lacto

Time	No. 3	No. 4	No. 5	No. 6
Starter	.85	.85	.85	.85
Mixed	1.00	1.10	.85	.97
1st day	.90	.83	.74	.73
2nd "	1.15	.90	.78	.76
3rd "	.95	.95	.89	.90
4th "	.90	.97	.78	.81
5th "	.90	1.00	.76	.85
6th "	.91	1.03	.89	.82
7th "	.90	1.04	.94	.82
8th "	.93	.96	—	—
15th "	1.00	1.10	.81	.85
18th "	1.00	1.03	.83	.92
22nd "	1.00	1.03	.72	.82
27th "	.98	.98	.77	.72
33rd "	81	.74	—	—

CHART II

VARIATIONS IN PERCENTAGE OF NORMAL ACID DURING STORAGE



It is to be observed that a high acid content forces the bacterial content downward. There is no correlation between increase in numbers and increase in acidity. There is no marked variation in the acidities of one sample at different times.

MEDICINAL AND FOOD VALUES OF LACTO

The medicinal value of lacto is due to the lactic acid bacteria and the acid which it contains. There was not found to be any further production of acid after freezing.

Great numbers of bacteria are taken into the stomach with foods especially such as milk and fruits. In some cases these bacteria continue their fermentative action within the body. Their food materials are present and there is generally oxygen at hand for those forms that need it. The digestive juices exercise a strongly antiseptic action, but when great numbers of bacteria are taken into the body, many escape destruction, especially when the stomach is nearly empty and the glands are not active.*

In some classes of animals it is claimed that bacteria aid in the fermentation of cellulose. Man does not commonly eat foods containing cellulose, so that the beneficial action of bacteria may well be doubted. Many forms of bacteria taken into the body are actually harmful. It is desirable to get rid of them if possible. Metchnikoff in his famous book, "The Prolongation of Life," has suggested as a remedy the taking into the body of lactic acid bacteria. He recommends the Bulgarian bacillus found in the sour milk drinks of Bulgaria. Investigations show that other forms of lactic acid bacteria serve the purpose as well. Hence there can be seen the medicinal application of lacto which as the bacteriological analysis shows, contains practically no bacteria but those which produce lactic acid.

The eating of lacto, with its .9 of 1 per cent of lactic acid, will produce an acid condition of the intestinal contents. This is very unfavorable to the putrefactive bacteria which may be there. The lactic acid bacteria themselves (*Streptoccocus lacticus*) can in no way prove injurious to health. It is probable that the beneficial lactic acid bacteria which as shown by the analyses were for the most part still alive, will take footing and supplant other forms within the intestines, even other acid producers of the *Bacillus coli* and *Bacillus lactis aerogenes* types, which Nature allows to live in the intestines. The more lacto is used the more chance there is that this change will take place. It would take much experimenting to decide this matter to a certainty.

* Herter: Bacterial Infections of the Digestive Tract, p. 6.

LACTO AS COMPARED WITH ICE CREAM

As previously shown, the flora of lacto consists of only beneficial lactic acid producers. Herein it varies greatly from ice cream. The flora of ice cream may be composed of almost any combination of types of organisms. Milk and cream for ice cream manufacture must be sweet. It cannot contain many of the beneficial lactic acid producers. Lacto milk must be sour, and its flora consists of nothing but bacteria of the last named class.

The composition of lacto and ice cream should not be greatly different. The protein of lacto is high because of the use of the skim milk and eggs. The only essential variations are in the fat and in the acid content, the fat of ice cream being much higher, and its acidity, of course, very low. As far as actual food value goes, however, lacto is not subject to much criticism because of lack of fat. The absorptive power of the body for fat is small as compared with that for proteins and sugars, hence when a food substance with so great a quantity of fat as ice cream is eaten the fat lies unused in the intestines. The alkaline bases of the digestive juices react with it to form soaps and the alkali needed in the digestive process is thus lost.*

It is not expected that the ice cream will be condemned as an inferior or unhealthy product and lacto used exclusively in its place. It is not intended to discourage the use of ice cream. The material given is merely to show some of the advantages of lacto. After all it is the consumer's palate which decides the matter and not his knowledge of relative healthfulness.

LACTO AS COMPARED WITH SHERBETS AND ICES

Sherbets and ices are much more likely to be displaced by lacto than is ice cream. Sherbets and ices are really so much frozen water, flavored. They carry only a pleasant taste and practically no nutriment. Lacto carries a more pleasant flavor and contains a considerable amount of real nutriment.

* Bulletin, 56, Hygenic Lab., p. 74